ARIZONA TRANSPORTATION RESEARCH CENTER

RESEARCH NOTES:

Project 615

September 2007

ITS Concepts for Rural Corridor Management

Background

The Arizona Department of Transportation (ADOT) began strategic planning in 1997 for rural deployment of Intelligent Transportation Systems (ITS). Earlier rural corridor studies evolved to a *Strategic Plan for Statewide Deployment of Intelligent Transportation Systems in Arizona*, in 1998. The key deployment elements of the Strategic Plan continue to be refined by the ADOT Transportation Technology Group.

ADOT soon recognized the need to measure progress and identify issues in the rural highway environment. A new research project was initiated, the *Rural ITS Progress Study – Arizona 2004*. This study measured the performance and documented the benefits of all currently deployed systems, and it delivered 20 key recommendations to ADOT for improved utilization of the rural ITS infrastructure.

By 2006, ADOT had successfully implemented most of the recommendations of the statewide study. At that point, rural stakeholders identified five key areas as still having unmet needs or unfulfilled potential. These *five core topics* are ITS maintenance, weather information systems, highway advisory information, motorist assist patrols, and information sharing.

On this basis, Project 615 reviewed state-of-the-art rural ITS concepts and business models to fully implement the potential of all the recommendations of the 2004 study, and to better meet the needs of ADOT's rural ITS program. The objectives were to:

- Document the existing conditions of ADOT's rural ITS deployment.
- Identify the stakeholders' current needs that ITS can address.
- Research state-of-the-art technologies and business practices in use by other agencies.
- Develop ITS concepts that can be deployed in Arizona's rural settings.
- Develop an Implementation Plan that will prioritize those ITS concepts.

District Needs

The initial tasks were to review the implementation status of all of ADOT's rural ITS infrastructure elements statewide, and to document District needs that ITS can address. The information was collected through interviews with senior staff in all of the Department's rural districts, and its Transportation Technology Group (TTG). Those interviewed were the core of ADOT's rural district management team, including all of the District Engineers and many of their engineering staff and field supervisors.

These field meetings sought local information on recent deployments or decommissioning of ITS devices, planned elements to be installed, and other ITS needs. Topics varied by region and by district, but they generally included Dynamic Message Signs (DMS), 511 travel information systems, highway advisory radio (HAR) or traveler information stations (TIS), road weather information systems (RWIS), motorist assist patrol (MAP) programs, closed-circuit television (CCTV) cameras, traffic detector systems, license plate reader systems, speed detection and warning systems, oversize/overweight load permitting, instrumented truck escape ramps, and roadside callbox systems.

Of the five project focus areas, ITS maintenance and weather information systems were identified by all of the Districts as most important. Each District had a particular vision for ITS programs and deployment, as well as individual ITS needs, some of which were corridor-specific. The field interviews showed that there are regional needs that cross district boundaries, with regard to varying storm and weather effects, incident detection and highway traffic monitoring, and relaying of traveler information to the public.

State-Of-The-Practice Investigation

The District interviews helped focus the research into current ITS technologies and business practices of public agencies nationwide. This involved reviews of the technology and business plans of innovative rural ITS systems, to identify the state-of-the-art.

The research team conducted a web-based survey of new products and innovations related to rural ITS. Topics included ITS maintenance and management practices and tools, weather information systems, highway advisory radio systems, motorist assist patrol fleet and program management, and innovative ITS technology transfer opportunities.

This research effort examined federal and state agency websites, transportation libraries, industry periodicals, pooled-fund studies, and reviews of new vendor products. The research team also attended a number of rural ITS conferences, where interviews were conducted with vendors, field experts, project and maintenance contractors, and other technical supervisors for their ITS-related experiences.

Study Findings

ITS Maintenance research identified successful third-party contracting for deployed ITS devices by the Colorado Department of Transportation (CDOT). An operations and maintenance contractor has been employed since 1998 to facilitate CDOT's program, showing the benefits of a properly funded and maintained system. Other programs in Florida and Montana have had varying success with operations and maintenance of ITS programs in-house.

Funding of programs remains an issue for agencies, whether done in-house or out-sourced. Budgetary constraints and adequate delivery of service are key challenges. In reviews of other southwestern states, Arizona generally ranked high for ITS deployments.

ADOT's deployment of weat*her information systems* is seen by other agencies as well-developed. A new contract for Road Weather Information Systems (RWIS) was initiated in 2006, with a contractor responsible for maintaining all of ADOT's RWIS sites, and being paid to deliver data. The research indicated that state agencies and the traveling public both benefit from the weather information presented in a user-friendly, accurate and timely manner.

The Utah Department of Transportation (UDOT) employs meteorologists for statewide monitoring of storm systems, and is a model of a single-point source for information and data analysis. National programs such as Clarus will serve as a weather information data collection service for participating states to provide and share weather data. Arizona can view neighboring states' weather data to assess approaching storms. Intergovernmental agreements (IGAs) allow state agencies to share weather data and information, for example, at flood monitoring sites. Mohave County and ADOT have had great success with such an IGA for data sharing.

Other weather technologies investigated include roadway icing monitors, automated anti-icing systems, and low-visibility detection and warning systems. Each of these technologies offers varying ability to assist ADOT in hazardous roadway conditions due to storms, ranging from reactive to proactive processes. Most weather monitoring technologies can be integrated with traveler information systems to alert motorists to changing roadway conditions.

Research on *Highway Advisory Radio (HAR)* found a plethora of options from permanent sites to portable units to synchronized services. The goal of HAR is to reach as many customers as possible with pertinent and timely information, using short-range AM radio to broadcast brief messages on roadway conditions or construction projects. The broadcast range limits the information delivered, and terrain is a challenge, but many public agencies employ HAR, as the broadcast messages can be updated easily and quickly.

Motorist Assist Patrol (MAP) programs are common in urban and suburban settings throughout the nation, especially for metropolitan areas with heavy traffic. In rural settings, MAPs are challenged by distance; incident detection and response times are hindered by the long routes and limited manpower. Contract rural MAP programs are used for construction projects to help stranded motorists in work zones. Volunteer-based programs are often limited to their free time.

Internal Information-Sharing opportunities abound in the traffic engineering industry, with both national

and state conferences. Professional societies have a strong presence in Arizona, including the Institute of Transportation Engineers (ITE), the Intelligent Transportation Society of America, and the International Municipal Signal Association (IMSA). These groups, as well as ADOT's Local Technical Assistance Program (LTAP), all offer periodic conferences and diverse training, but even with such opportunities, ADOT staff are challenged by limited time, long travel distances, and budgetary constraints.

Innovative solutions in areas of operational training and commercial vehicle permitting were also topics of interest; oversize and overweight loads may be monitored effectively by ADOT in future with ITS.

Implementation Plan & Recommendations

Based on the state-of-the-practice results in the five key ITS focus areas, 26 deployment concepts were proposed, and a detailed implementation plan was prepared for ADOT.

Each concept addresses the original-scope goals, and stakeholder needs from the field interview process. Key points for each topic include deployment benefits and challenges, the cost basis, and proposed site or corridor implementations.

Each of the proposed 26 ITS concepts includes an engineers' opinion of initial capital costs, annual operations and maintenance costs, and the estimated five-year funding required for each concept.

Prioritization & Process Ownership

The project's recommended concepts were prioritized by the Technical Advisory Committee (TAC), who also identified potential process owners or champions for each ITS concept. They also suggested potential ADOT resources for the deployment of these concepts, as shown below.

Some ITS elements may also qualify for Federal-aid construction project funds.

Engineers Opinion of ADOT Cost for Rural ITS Concepts

Deployment Concept	Initial / Capital Costs	*Annual* Cost: Operation & Maintenance	Opinion of Cost (*for 5 Years*)	TAC Consensus: Priority
Third-Party ITS Operations & Maintenance Contracting: - $200,000 Annual Contract	-	$200,000	$1,000,000	High
Truck Escape Ramp Monitoring: - 7 Sites at $125,000 Per Site (Total)	$700,000	$35,000	$875,000	Med
Expansion of Rural Cellular Coverage: – Major US Highways & State Routes	$75,000	-	$75,000	Med
DMS Construction: - 8 Sites at $312,500 Site (Total)	$2,300,000	$40,000	$2,500,000	High
Participation in Clarus - Database Development & Maintenance, Coordination with National Agency	-	$100,000	$500,000	High
RWIS Deployment: - 48 Sites at $112,000 Per Site (Total)	$768,000	$921,600	$5,376,000	Med
State Meteorologist: - One Position at $85,000 Annual Salary	-	$85,000	$425,000	High
Low Cost Weather Stations: - 40 Sites at $2,500 Per Site (Total)	$64,000	$7,200	$100,000	Med
Low Visibility Detection: - 15 Sites at $75,000 Per Site (Total)	$900,000	$45,000	$1,125,000	Med
Bridge Deck Anti-Icing Monitoring: - 3 Locations at $100,000/Site (Total)	$240,000	$12,000	$300,000	Low
Develop IGAs for Flood Detection Data: - 11 Counties at $70,000 (each)	$770,000		$770,000	Med
Mobile Data Collection w/ Satellite Communication: - 54 Snowplows at $12,000 / Vehicle (Total)	$540,000	$21,600	$648,000	Med
Portable Highway Advisory Radio: – 8 Units at $30,000 Each (Total)	$200,000	$8,000	$240,000	Med

Deployment Concept	Initial / Capital Costs	*Annual* Cost: Operation & Maintenance	Opinion of Cost (*for 5 Years*)	TAC Consensus: Priority
Work Zone HAR Specification Development: – One-Time Consultant Fee	$5,000	-	$5,000	Med
Permanent HAR Sites: - 20 Sites at $25,000 Per Site (Total)	$400,000	$20,000	$500,000	High
Intelligent Rest Area Deployment: - 15 Sites at $48,000 Per Site (Total)	$645,000	$15,000	$720,000	Low
Corridor Travel Time Monitoring: - 8 Sites at $112,500 Per Site (Total)	$800,000	$20,000	$900,000	High
Emergency Detour Routing: - 33 EMS at $6,000 Per Sign (Total)	$148,500	$9,900	$198,000	High
MAP Specification Development: - One-Time Consultant Fee	$30,000	-	$30,000	Med
CRASH Vehicles: - 20 Vehicles at $90,000 Per Vehicle	-	$360,000	$1,800,000	Med
Enhance Field Communications with Phoenix District - 50 800 MHz Radios at $1,500 each, Installed	$75,000	-	$75,000	Med
ADOT VHF Radios in DPS Vehicles - 440 Units at $1,500 Installed; Total $660,000 **All Costs by DPS*	*	*	$0	Med
District Training Programs: - Consultant Fees for Protocol Updates	-	$8,000	$40,000	Med
Oversized Load Management: Initial Implementation of System by ADOT. ** System Expansion and Ongoing Costs Absorbed by Industry Agencies*	$400,000	*	$400,000	Med
Simulator Interagency Training - Support Activity by ADOT-LTAP for Coordination w/ Partner Agencies	-	$12,000	$60,000	High
Internal Information Sharing: - 5 Conferences Per Year for 20 Participants	-	$50,000	$250,000	High

Total Engineers Opinion of Five-Year ADOT Cost for Rural ITS Concepts

Focus Areas Deployment Concepts	Opinion of Total Cost
ITS Maintenance	$4,450,000
Weather Information Systems	$9,244,000
Traveler Information Systems	$2,563,000
Motorist Assistance and Safety Services	$1,945,000
Information Sharing	$710,000
TOTAL OVER 5 YEARS	$18,912,000
AVERAGE TOTAL COST PER YEAR	$3,782,400

The full report: *ITS Concepts For Rural Corridor Management* by Micah Henry and Michael Wendtland of ITS Engineers and Constructors (Arizona Department of Transportation, report no. FHWA-AZ-07-615, published September 2007) is available on the Internet. Educational and governmental agencies may order print copies from the Arizona Transportation Research Center, 206 S. 17 Ave., MD 075R, Phoenix, AZ 85007; Fax 602-712-3400. Businesses may order copies from ADOT's Engineering Records Section.